



National Aeronautics and  
Space Administration

**Educational Program**

**Educators  
& Students**

**Grades 3–4**

EP-2000-09-338-HQ

# NASA

## Student Involvement Program

### My Planet Earth



## Educator's Resource Guide

**2000–2001**

**National Competitions**

**NSIP**

**My Planet Earth  
Competition**



**W**elcome to **My Planet Earth!** This revised Educator's Resource

Guide provides background information and learning activities—including two from the GLOBE Program.

Use this Educator's Resource Guide together with the official NSIP Program Announcement brochure which provides full details on the NSIP Program, including a complete statement of rules, and forms for submitting your entry.

The guide is designed for teachers of grades 3–4. Feel free to adapt the materials and activities to make them easier or more challenging. Please contact us with any questions that you have in the course of using this Guide by emailing us at *info@NSIP.net*

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## Competition Categories

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Grades 3–4 . . . . .	Whole Class
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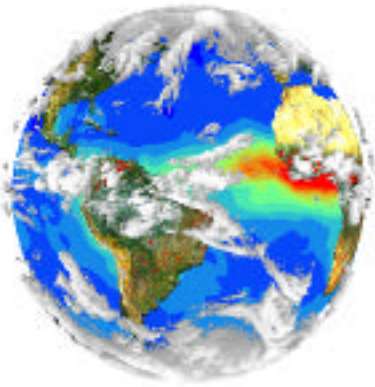
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# My Planet



Earth is a system of wonderfully interconnected parts working together. Notice how the natural and designed parts work together: clouds, soil, trees, birds, bugs, rivers, lakes, roads, cars, towns, bridges, dams...all contribute to shaping this amazing world. The connections happen at the local level (your neighborhood), at regional levels (such as your local watershed), and all the way to the global level. Scientists investigate Earth at all of these levels, and with the help of satellite observations they have created a rich perspective on our home planet: the Earth is a marvelous home to myriad complex interactions among air, water, land, and life.



## What Your Students Will Learn

Choose a study site near the school, and divide the class into four teams so that each observes a different aspect of the environment: air, water, land, and life. Once they share and compare notes, the teams will find that some of their observations overlap. The interaction among teams mirrors the interaction of air, water, land and life. This sets the stage for an open-ended exploration of the planet within the familiar environment of their neighborhood—with a focus on their own discoveries and questions. With your help, students will put their observations together in words, pictures, maps, photographs, diagrams and graphs to show the connections among different parts of the big picture.

Students will learn fundamental inquiry and investigation skills in accordance with national standards for science education:

- Develop skills of scientific inquiry.
- Learn core concepts of Earth science.
- Understand concepts of systems, components and connections.
- Perceive the linkages between a local site and the larger environment.
- Use measurements, graphs, and diagrams to convey science concepts.
- Appreciate science within personal and social perspectives.
- Work collaboratively as team members.
- Communicate more clearly and effectively.

# Let's Go Outside!

## Explore Planet Earth in Your Own Neighborhood

The following multi-stage process is intended to help you and your students select a study site, observe and collect data, pool your findings, and write a report together. Creativity is encouraged, so feel free to use whatever approach works for you and your students. Use your favorite activities to get students actively observing, drawing, measuring, and learning!

Sample activities are included in this guide. A sample worksheet for recording student observations and questions is also included ("Appendix: My Planet Earth—Sample Observation Log," pg. 19). It is only a sample and its use is not mandatory, so feel free to use or modify it to suit your needs. If your students already keep a science journal, then they may not need a separate worksheet. In any case, note the important features of the worksheet and adapt these to your needs and circumstances.



### I. Pick Your Study Site

Divide your class into *four teams*. Assign a different aspect of the environment to each team: *land, air, water, and life*. Students should grab their science journals and head outside to the study site you choose where they will note what they see, hear, smell and touch at their study site. Your site should be an area in their local environment on which they can walk about, make observations and collect data. If it is private property, your group will require permission to be there. It should be convenient to the school so students can visit it safely, and it should be free of any hazards that might cause injury. (Note: *Air* is a hard thing to observe, especially for young students! You may want to alert them to the few accessible observations, like air temperature in sun vs. shade, and wind direction. Also include that portion of life that lives in the air. This will allow them to work with more than "thin" air!)

### II. Do You See What I See?

Your students should visit their site more than once. Initially, they should simply observe with an open mind. Each team will observe and take notes on elements of the site that have to do with their assigned environmental category. Wherever possible and appropriate, students should measure and graph aspects of the world they are observing. Encourage them to notice as many elements as possible—soil, water, ground cover, shrubs, trees, birds, weather, sunlight, etc. On repeat visits, they should look for more details and notice changes from previous visits. Students should record their observations,

including sketches and the questions that they come up with, in a notebook. It helps to take photos so that descriptive details can be recalled and further developed back in the classroom. (Refer to the "Simply Observing" activity, on pg. 11 of this Guide). In correlation with their site observations, students should learn more about how Earth as a planet operates. See the "Resources" section of this Guide (on pg. 18) for some starting points, for example, *Our Mission to Planet Earth*, (a NASA K–4 Educator's Guide), *How the Earth Works*, and *Nature Cross-Sections*.

### III. Describe the Parts and Connections

Students should list the key things that they see in the study site, and then describe how these things are interconnected. Include the most immediately observable features, such as the color and texture of the soil, the birdsongs they hear, the kinds of trees and plants they find, squirrels, bugs, hills and valleys, sunny and shaded areas, puddles and ponds, trails, clouds, and other features. Also include connections that are not directly observable, such as the trees drawing nutrients from the soil. Students should draw pictures with captions and labels illustrating the components and connections.

If your school is in the middle of the city: you might pick a nearby park, and observe the same components—sunlight, plants, birds, animals, water, weather, and soil—but add people to the scene, and observe how their presence affects the natural setting.





#### IV. Collect and Display Data

Students should collect data that help them answer questions that they have brought up over the course of their visits to the site. They may also want to gather data to add more detail to their picture of the study site. Activities included in this Guide, in addition to books listed in the "Resources" section, will provide some tried and true education products. Students may use measuring tape to measure the site's dimensions. You might observe, identify and count types of plants, measure any bodies of water, list names of birds, measure rainfall over a period of time, or determine the number of hours of sunlight per day. If the site is urban, students might measure the surface area available for plants (whether in parks or planters), find areas where pigeons congregate and count them, or determine where rainfall goes after it hits the surface. Work with your students. Encourage them to use the data to deepen the description and representations of their site. Your descriptions and pictures of the site might raise new questions and issues which, in turn, may lead to new data collection.

#### V. The Big Picture: The Whole Class Makes the Connection

Back in the classroom, student teams will come together and compare notes. The whole group should look for overlapping observations and note connections, for instance, between the observations of the land team and the water team. With your help, students will pool their observations together in the form of pictures, words, and arrows connecting different parts of the big picture. Once they share and compare notes, the teams will find that some of their observations overlap. The resulting interaction among teams will mirror the interaction of air, water, land, and life. This sets the stage for an exciting open-ended exploration of the planet within the familiar environment of their neighborhood. You may also use other sources of information about the site: a topographical map of the region, a guidebook to plants and animals, or a local expert, a park ranger for example, who has studied the area and can answer students' questions directly. These resources will help your students understand the larger context around the study site.

## VI. Putting it All Together: Prepare Your Report

Ultimately, you and your students will prepare and submit an integrated report on “My Planet Earth.” The report will describe your study site, with a particular focus on its key components and interconnections, and students’ own questions. It should clearly demonstrate teamwork between teacher and students. The report will be judged on the quality of the observations, questions, and demonstrated level of understanding. The report should include a written component plus visuals, such as illustrations, maps, photos, or graphs. The maximum length is 1,500 words, excluding the illustrations and resource credits. Your report should have the following components:

*(The following description of entry components was taken from the NSIP 2000–2001 Program Announcement. A few examples have been added here to help clarify the Research Basis component.)*

### I. Study Site Description—

*Teacher and students* select, observe, and describe a study site that is near their school with dimensions of about 100 x 100 meters. *The teacher* will provide a written description of the site, accompanied by students’ drawings, maps, photographs, diagrams, and/or graphs. *Student teams* will describe what they observed and raise questions about how the different parts of the study site might be related. *The teacher* will create a clearly labeled illustration of the site and its components, and use arrows to show the relationships that students have discovered and described. The illustration should accompany a description written by *the teacher*.

**II. Research Basis—**Describe how you conducted your research. The teacher will describe what measurements and observations were made by each group and how these were recorded. Provide a statement regarding what was

done before you went to the field: what information, concepts, and skills were taught? For example, you may have prepared students with a unit on geography, or Earth science; or perhaps you used activities on how to make and record observations, or how to use maps, rulers, and thermometers. Describe the tools or instruments that students used for the project.

**III. Resource Credits—**The teacher will list all reference books, periodicals, web sites, images, and people (including names, work titles, and type of help provided) that contributed to the project. This section is not included in the word count.

*You are advised to examine the Judging Rubrics in the next section (pgs. 6–9) to get a clear idea of how these components will be evaluated.*



# My Planet Earth

## JUDGING RUBRICS

100 Points Total

NOTE: The following Judging Rubrics supersede the abbreviated "Judging Criteria" that appear in the NSIP 2000–2001 Program Announcement brochure.

### YOUR STUDY SITE, ITS COMPONENTS, AND THEIR INTERRELATIONS

40 Points Total (For breakdown, see Rubric Table on pg. 8)

#### 1. Study Site Description: Is the study site described clearly; are different elements identified, and does the diagram identify the four categories of life, land, water, and air, and show their inter-connections?

---

- 0 Only a cursory description of the site is given.
- 1 A description of the site is given, with only passing attention to the four categories of life, water, air, and land.
- 2 A detailed description is given, observations are organized according to the categories, student diagram is included that shows interconnections.
- 3 A detailed description is given, observations are organized by category, areas of overlapping observations are identified; student diagram is included.
- 4 A detailed description is given, observations are organized by category, areas of overlapping observations are identified; diagram contains data and graphs.

#### 2. Data and Graphics: Does the report utilize relevant data and graphs to address the students' research questions?

---

- 0 No pictures, data, or graphs are present.
- 1 Pictures, data, or graphs are present, but have little relevance to the students' research questions.
- 2 Pictures, data, and graphs are present and have some relevance to the students' research questions.
- 3 Pictures, data, and graphs effectively address students' questions.
- 4 Pictures, data, and graphs effectively address the research question and data are presented clearly and informatively.

#### 3. What Did Students Learn? Did students learn to use their observations to answer their own questions about how the parts of the site work together and about how the Earth works?

---

- 0 Only a few, if any, student questions are presented.
- 1 Student questions are presented, with only passing attention to the four categories of life, water, air, and land.
- 2 Student questions are presented; entry shows that their observations addressed their questions.
- 3 Students raise thoughtful questions about how the different parts of the study site work together; the entry demonstrates that observations, maps, data, and graphs all contribute to answering student questions.
- 4 Students raise thoughtful questions about how the different parts of the study site work together. Observations, maps, data, and graphs answer student questions. Special emphasis is placed on how the parts of the small-scale study site relate to the parts of planet Earth.



## RESEARCH BASIS

30 Points Total (For breakdown, see Rubric Table on pg. 9)

### 1. Research Plan: *How did your class conduct the research?*

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- 0 No plan is included.
- 1 Plan is unclear; most steps are missing or confused.
- 2 Plan is somewhat clear; main steps are present; students' roles are clear.
- 3 Plan is clearly stated, most steps are present; plan identifies specific pictures, maps, measurements of the study site; students' roles are clear.
- 4 Plan is clearly stated and comprehensive; plan identifies specific pictures, maps, measurements of the study site, students' roles are clear.

### 2. Background Research: *What concepts, skills, and information were used to prepare the students for their fieldwork?*

---

- 0 No background research is described.
- 1 Background research doesn't relate to the specifics of the selected study site.
- 2 Background research addresses specifics (geographical or historical facts) of their site.
- 3 Background research addresses specifics of the selected study site; or includes how to use maps, measurements, tables, and graphs.
- 4 Background research addresses specifics of the selected study site; and includes how to use maps, measurements, tables, and graphs; includes Earth science.

## COMMUNICATION

30 Points Total (For breakdown, see Rubric Table on pg. 9)

### 1. Presentation of Research and Conclusions

---

- 0 Poor presentation, evidence of last minute efforts, no clear organization, significant components are missing.
- 1 Presentation is plain, but lacks clear organization, not engaging; poor presentation of data and graphs.
- 2 Presentation is plain, somewhat clearly organized, somewhat engaging; data and graphs are presented adequately.
- 3 Presentation is neat, original, clearly organized, and engaging; data and graphics are informative.
- 4 Presentation is creative and original, clearly organized; engaging and persuasive; data and graphics are informative.

### 2. Resource Credits

---

- 0 Resources are not present.
- 1 Minimal resources are cited.
- 2 Contains citations from few sources; citations are indirectly related to the report.
- 3 Contains some relevant citations from multiple sources (i.e., not exclusively Internet); citations are directly related to the report.
- 4 Contains many relevant citations from multiple sources (i.e., not exclusively Internet); citations are directly related to the report.

**YOUR STUDY SITE, ITS COMPONENTS, & THEIR INTERRELATIONS** 40 Pts. Total

POINTS	1. STUDY SITE DESCRIPTION <i>Is the study site described clearly; are different elements identified, and does the diagram identify the four categories of life, land, water, air, and show their inter-connections?</i>	2. DATA AND GRAPHICS <i>Does the report utilize relevant data and graphs to address the student's research questions?</i>	3. WHAT DID STUDENTS LEARN? <i>Did students learn to use their observations to answer their own questions about how the parts of the site work together and about how the Earth works?</i>
0	Only a cursory description of the site is given.	No pictures, data, or graphs are present.	Only a few, if any, student questions are presented.
1	A description of the site is given, with only passing attention to the four categories of life, water, air, and land.	Pictures, data, or graphs are present, but have little relevance to the students' research questions.	Student questions are presented, with only passing attention to the four categories of life, water, air, and land.
2	A detailed description is given, observations are organized according to the categories, student diagram is included that shows interconnections.	Pictures, data, and graphs are present and have some relevance to the students' research questions.	Student questions are presented; entry shows that their observations addressed their questions.
3	A detailed description is given, observations are organized by category, areas of overlapping observations are identified; student diagram is included.	Pictures, data, and graphs effectively address students' questions.	Students raise thoughtful question about how the different parts of the study site work together; the entry demonstrates that observations, maps, data, and graphs all contribute to answering student questions.
4	A detailed description is given, observations are organized by category, areas of overlapping observations are identified; diagram contains data and graphs.	Pictures, data, and graphs effectively address the research question and data are presented clearly and informatively.	Students raise thoughtful question about how the different parts of the study site work together. Observations, maps, data, and graphs answer student questions. Special emphasis is placed on how the parts of the small-scale study site relate to the parts of planet Earth.
	Points _____ x 15 =  Subtotal _____	Points _____ x 10 =  Subtotal _____	Points _____ x 15 =  Subtotal _____

Total of Above Subtotals \_\_\_\_\_ ÷ 4 = \_\_\_\_\_

**TOTAL POINTS**

## RESEARCH BASIS 30 Pts. Total

POINTS	1. RESEARCH PLAN <i>How did your class conduct the research?</i>	2. BACKGROUND RESEARCH <i>What concepts, skills, and information were used to prepare the students for their fieldwork?</i>
0	No plan is included.	No background research is described.
1	Plan is unclear; most steps are missing or confused.	Background research doesn't relate to the specifics of the selected study site.
2	Plan is somewhat clear; main steps are present; students roles are clear.	Background research addresses specifics (geographical or historical facts) of their site.
3	Plan is clearly stated, most steps are present; plan identifies specific pictures, maps, measurements of the study site; students roles are clear.	Background research addresses specifics of the selected study site; or includes how to use maps, measurements, tables, and graphs.
4	Plan is clearly stated, and comprehensive; plan identifies specific pictures, maps, measurements of the study site; students roles are clear.	Background research addresses specifics of the selected study site; and includes how to use maps, measurements, tables, and graphs; includes Earth science.
	Points _____ x 15 = Subtotal _____	Points _____ x 15 = Subtotal _____
	Subtotal _____ + Subtotal _____ =	

Total of Above Subtotals \_\_\_\_\_ ÷ 4 = \_\_\_\_\_  
**TOTAL POINTS**

## COMMUNICATION 30 Pts. Total

POINTS	1. PRESENTATION OF RESEARCH AND CONCLUSIONS	2. RESOURCE CREDITS
0	Poor presentation, evidence of last minute efforts, no clear organization, significant components are missing.	Resources are not present.
1	Presentation is plain, but lacks clear organization, not engaging; poor presentation of data and graphs.	Minimal resources are cited.
2	Presentation is plain, somewhat clearly organized, somewhat engaging; data and graphs are presented adequately.	Contains citations from few sources; citations are indirectly related to the report.
3	Presentation is neat, original, clearly organized, and engaging; data and graphics are informative.	Contains some relevant citations from multiple sources (i.e., not exclusively Internet); citations are directly related to the report.
4	Presentation is creative and original, clearly organized; engaging and persuasive; data and graphics are informative.	Contains many relevant citations from multiple sources (i.e., not exclusively Internet); citations are directly related to the report.
	Points _____ x 6 = Subtotal _____	Points _____ x 1.5 = Subtotal _____
	Subtotal _____ + Subtotal _____ =	

**TOTAL POINTS** \_\_\_\_\_



# Two Sample Studies



## I. Woodland Pond Study Site

If this were your study site, your students might use the pond as a starting point for their project. What role does this pond have in the systems at work here? Where does the water come from? Where does it go? How do plants get water from the pond? Do fish live in the pond? Can you see any other signs of life in the pond? Your students might measure the size of the pond and see if it changes from one season to the next (perhaps this is a vernal pond that only has water in the spring and summer). Students might check moisture levels in the soil starting at the edge of the pond, then one foot away, then two feet away, and so on.

Students can simply check how wet the soil feels with their fingers or they can take a soil sample to the classroom, weigh it when it is wet, then let the water evaporate and weigh it again. (See the GLOBE soil activities on pgs. 12–17 for details and worksheets.) Students might compare the bushes and trees near the pond with trees and bushes that are farther away, or look for tracks of animals that might come to the pond to drink water.

As your students observe, measure and study the pond, have them draw what they see, and then add labels and comments about the pond and how it relates to the environment around it.

## II. Desert Study Site

A desert setting is almost the opposite of the pond site. In that example, the pond was the focal element virtually defining the system. Here, the absence of water is the defining element. How do the plants and animals get the water they need? If your students live in this type of environment, they may already be familiar with the wonderful ways that desert life has adapted to find, gather, store and use water. You might decide find a local expert (a park ranger or naturalist) to help the students learn. Or you can simply have your students observe closely and carefully—can they see water anywhere? Some water might be in underground aquifers that are not visible but which may approach the surface as evidenced by an abundance of green plants in a valley region. Students might find a fallen cactus and see moisture oozing from it. Visit the study site after a thunderstorm (such cloudbursts might be common in your site) and notice how the cactus flowers collect rainfall. Students might see a bird fly to the cactus and drink the water held in the flower. Have your students draw the desert scene, and then show how water enters the site, how it is gathered, stored and used by plants, birds, insects and mammals, and how it leaves the site.

# Three Sample Learning Activities



Any suitable environmental learning activity will work, and there are a great many that can be adapted to My Planet Earth. This Educator's Resource Guide offers three: the first focuses on observation—a necessary skill fundamental to science in general and this NSIP competition in particular. The other two activities come from the GLOBE program Teacher's Guide.



## Sample Activity 1 SIMPLY OBSERVING

### ■ Stop, look & listen.

The best way for your students to begin work on this NSIP competition is to go to the study site and simply observe. Have them look, listen and, if appropriate, smell and touch. The more time they devote to observing, the more they will notice. Repeated visits will lead to deeper and more detailed observations and understanding.

### ■ Discuss what they see.

While you are still at the study site, have students describe what they see. Ask questions to extend the discussion. Did they see insects, animals or birds? How tall are the trees? What ground cover do they see? Does sunlight reach the ground? Does water flow through? What is the soil like? Do leaves cover the soil and, if so, how deep?

### ■ Use a field notebook.

Each student should have a field notebook to record notes, thoughts and observations. They should include sketches of leaves, rocks, animal footprints, streams, bushes, trees, etc., as well as record measurements or other data in the notebooks. Encourage your students to record any questions, as well.

### ■ Map the area.

Have students imagine they are birds flying overhead. What does the area look like? Have them draw a picture from above, showing key features such as ponds, rivers, forests, roads and so on. If you have a map (such as a detailed park map), cross-reference it with the student maps. Your students' pictures may include more detail in the representation of plants and other natural features, whereas the park map may be more accurate in terms of scale, location, and size. You might have students use the park map as a starting point to which they add details.

### ■ Focus on the connections.

On at least one of your visits, have your students focus on observing the connections among the diverse components. How does water get from the pond to the trees? What birds, insects and mammals make their homes in the trees? How do leaves become part of the soil?

## Sample Activities 2 & 3 GLOBE SOIL ACTIVITIES

### ■ A Few Words of Introduction

Using activities from the GLOBE\* Program Teacher's Guide offers many advantages, in particular, the following: these activities have been used and tested by thousands of teachers and students around the world. They are of particularly high educational quality and very easy to use. Therefore the activities will provide a ready-to-use format for My Planet Earth research projects, and will strengthen your competition entry. We have included only two of six GLOBE activities for studying soil. You may want to examine other sections of the GLOBE Teacher's Guide (<http://www.globe.gov>) for other ideas and activities. Finally, these activities provide a wonderful introduction to the GLOBE program's many benefits for students and educators. If you are already a GLOBE teacher, the NSIP competitions provide a forum for your students to gain broader recognition for their research.



*\*Global Learning and Observations to Benefit the Environment (GLOBE) is a hands-on international environmental science and education program. GLOBE links students, teachers, and the scientific research community in an effort to learn more about our environment through student data collection and observation.*

#### **The goals of GLOBE are:**

*To enhance the environmental awareness of individuals throughout the world;  
To contribute to scientific understanding of the Earth; and  
To help all students reach higher levels of achievement in science and mathematics."*

—GLOBE Teacher's Guide, pg.6





# Soil and My Backyard



## Purpose

To explore soil and soil properties

## Overview

Students will discover the variability of soils, derive relationships among soils and the soil forming factors, and link the GLOBE Soil Investigation to the students' local environment. Students use soil samples from their homes to identify properties that characterize their soils. They compare and contrast their soils to those of their classmates. As a class, students describe relationships between the properties of their soils and how and where they were sampled. Older students construct a soil classification schema.

## Time

One class period to observe soil properties and one or two periods for discussion

If soils are to be dried and changes observed, an additional class period will be needed.

## Level

All

## Key Concepts

Soils vary within a small local area

Soil properties are related to the soil forming factors.

Soil can be classified according to its properties.

## Skills

Sampling of soil

Classifying soil

## Materials and Tools

Newspaper

1 liter plastic bags

Local map (topographic or road map which encompasses the school district)

Magnifying glass.

## Preparation

On the day of the activity, prepare an area in the room for observing the soils. For example, cover lab tables with newspaper. If students will be drying their samples, you will need to identify a place where soils can be left undisturbed for several days. See the instructions for drying soils in *The Soil Protocols – How to Perform Your Soil Measurement*.

## Prerequisites

None

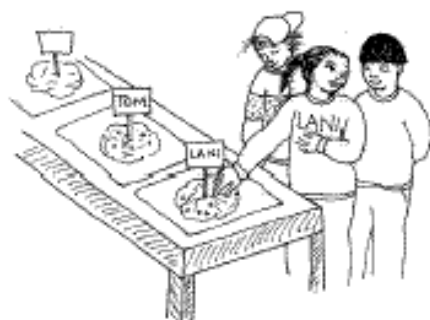
## Background

Soils vary in their properties depending on where they have been sampled on a landscape and from what depth they were sampled. As your students examine their soils, help them to think about what they are observing by asking: What properties do you notice? Are the soils wet or dry? What colors do you see? Can you identify the components (organic material [both plant and animal], rock fragments, sand, clay, etc.) of your soils? How does the soil smell? How do the soils

feel? How do dry soils differ from the original soil samples? Are there differences within a single soil sample? How does your sampling procedure effect what you see? How would you group or classify their soils?

## What To Do and How To Do It

Before giving the student the homework assignment of collecting soil samples ask them to hypothesize how many different types of soils the individuals in the class can find in their



neighborhoods. They need to use previous experience or knowledge to answer the question.

### **Before Class**

Have students bring soil samples from home, using 1 liter plastic bags. They should document their collection methods (such as noting the location from which each sample was taken, the depth of the soil, storage methods, etc.). For younger students you may want to establish a class protocol for sample collection – either through a brainstorming activity or by providing one.

### **During Class**

In the classroom, students should spread out their soil samples and examine them closely. Record observations about the soil in their GLOBE Science Notebooks.

Have each student find one person in the class that has a soil similar to their own soil. Record how they determined that the soils were similar.

Have each student find one person in the class that has a soil that is different from their own soil. Record how they determined that the soils were different.

As a class, brainstorm and list on the board the different characteristics the students used to describe their soils. Ask the students to group characteristics that appear to belong together. Use words that describe these similarities, such as same color, same "feel," a number of roots. Have students describe how the observed soil properties relate to the soil forming factors.

Discuss what factors could lead to the different characteristics (five soil forming factors, sampling effects, etc.).

Ask the students to compare their observations with their hypotheses about how many types of soil they are likely to have represented in the class samples.

Ask them to discuss how their knowledge of the soil characteristics changed based on their investigations. What did they learn? Be specific listing such things as soil characteristics, how soil may vary in characteristics within a relatively small area, etc.

### **Adaptations for Younger and Older Students**

Younger students should focus on making observations and comparisons.

Older students can perform more in-depth investigations in teams or as a class by:

- Developing a standardized procedure for soil sampling and having your students bring in a second sample collected by following the class procedure. Compare each set of samples.

- Developing a scheme to classify soils based on soil properties.

- Drying the soil samples for different lengths of time and comparing physical differences between soil in various states of moisture.

- Plotting on a local map sample collection sites and the distribution of the various soil classes.

### **Further Investigations**

Find out where there is digging (excavation) going on nearby and visit the site, comparing what you observe there with the soil characteristics described in your backyards.

Remember: Safety is always your first concern.

Select another school in a part of the world known for certain characteristics (e.g. a rainy season, thick vegetation, etc.). Pick a school that has a history of submitting messages and/or data. Write a note to the students via GLOBEMail describing your soil and asking them to describe their soil to you. How do the differences in your climates (for example types of seasonal cycle, temperature ranges, amounts of precipitation, types of land cover) relate to the differences in your soils?

Welcome

Introduction

Protocols

Learning Activities

Appendix

Soil and My Backyard



Compare your results with those of the other school and discuss any difference with your GLOBE colleagues at your school and the other school.

Investigate what kinds of soils make the best homes for earthworms or other soil-dwelling creatures.

Develop a scheme for grouping (classifying) soils based on soil properties.



### **Student Assessment**

Give students samples of a mystery soil. Depending on their age, they could:

Describe the soil in their GLOBE Science Notebooks, using as many adjectives as possible and covering as many soil characteristics outlined in the Soil Characterization Information Sheet as can be observed.



Consider the implications of the characteristics for its possible history and location.





# From Mud Pies to Bricks



## Purpose

To introduce the different particle sizes of soils and the properties which each contributes to the soil character

## Overview

Students will sift soil to remove organic materials and pebbles. They will then sift the soil with smaller meshed sieves to separate clay and sand. Students will make mud pies by adding water to the various soil components, letting them dry and observing the pie's characteristics. Finally, students will be challenged to create the perfect mud pie or building brick using combinations of soil components.

## Time

One class period to sift soils and make mud pies  
Overnight to dry  
One class period to experiment with creating bricks  
Overnight to dry

## Level

All

## Key Concepts

Soil is composed of a variety of materials.  
The size of soil particles helps determine the soil characteristics.  
Soil is important as a building material.

## Skills

Sifting soil samples  
Observing differences in particles  
Measuring or weighing soil  
Designing experiments  
Testing results

## Materials and Tools

1 liter soil (loam) for each student group  
Several sizes of mesh screen or sieves for sifting  
Straw (dried grass clippings)  
Additional powdered clay and sand  
Old ice cube trays (for brick molds)  
Small plastic lids or plates (for pies)  
Plastic table cloth

## Prerequisites

None

## Background

Soil is made up of many different size grains of broken-down rock (sand, silt and clay). How much water a soil will hold, how easily water passes through the soil, and what happens to the soil as it dries depends on the combination of these materials in your particular soil. Soil with too much clay may crack as it dries - you have probably seen pictures of ground with huge cracks or observed the cracking at the top of a mud puddle when larger, heavier particles have settled to the bottom. Soil with too much sand may not hold together well or be strong enough as a building material.

Soil has been used as a building material for thousands of years, and is still one of our most important building materials. In dry regions houses built of adobe bricks last hundreds of years. Concrete and bricks are common everywhere. Whether you are making concrete or adobe blocks, it is important to understand the importance of having the right elements in your soil mix.

## What to Do and How to Do It

### Observation

1. Ask students to examine the soil carefully using their eyes, hands, and a magnifying glass.

2. Make a list of the things students observe about the soil. For example: *different size, shape, and color of grains, other soil materials such as sticks or leaves, 'dustiness', weight, etc.*
3. Ask students if they think the soil would be different if all of the particles were alike or if some parts were missing. How would it be different?
4. Starting with the largest mesh sieves, sift the soil.
5. Place what does not go through the sieve in one pile - these are the largest particles.
6. Ask students to examine the 2 piles. How are they alike and different? Can they think of reasons why different size particles would be good for different things?
7. Take the soil that passed through the sieve and sift it through the next smaller mesh.
8. Keep what did not go through the sieve separate, and continue sifting through smaller mesh screens. Students will now have several piles of soil separated by the size of the particles.
9. Ask students to identify words that describe the different piles of soil they now have. Identify the concept of particle size: sand, silt and clay. Words might include: *powdery, rough, smooth, dusty, etc.*

### Experimenting

1. Discuss with students the importance of soil as a building material. Ask students to identify things that are built with soil. Example: *concrete sidewalks, brick buildings*
2. Have students describe how they would make a brick using the soil they have.
3. Ask students to describe the characteristics of a good mud pie or brick. For example: *hardness, cracking, resistance to breaking or water, etc.*
4. Ask students to guess which pile of soil would make the best mud pie or brick. Why did they choose the pile of soil that they did? What will happen to each pile when water is added to it?
5. Have students make mud pies or bricks from the soil in each pile by adding water

then molding by hand or putting into a mold like an old ice cube tray.

6. Dry completely in the sun or in a warm place.
7. Ask students to test the mud pies or bricks that they made for breaking, cracking, smoothness, etc.. List what is good or bad about each one.

### More Challenging

1. Challenge students to create the perfect mud pie or brick by combining different amounts of the soil particles they sifted out. Additional sand, clay or organic material may be provided, especially if your original soil did not contain very much of one of these elements. Have students measure or weigh the different ingredients and write a 'recipe' so that they can compare with other students or recreate their creation.
2. Older students can figure the percent weight of each soil component in their recipe.

### Further Investigations

1. What happens when the dried bricks get wet? Research how adobe houses are protected from rain.
2. Examine a piece of broken brick. What soil elements can you identify? Why are bricks water resistant?

### Assessment

Have students observe soils around their school or at their biology site. Ask how they can determine areas which have more clay or more sand.

Recipe Card	amount
<b>Ingredients:</b>	
<i>clay (smallest size particles)</i>	
<i>silt (medium size particles)</i>	
<i>sand (large size particles)</i>	
<i>other</i>	
<i>other</i>	

Welcome

Introduction

Protocols

Learning Activities

Appendix

From Mud Pies to Bricks

# Resources

These resources are updated periodically. Check the My Planet Earth web site at [http://www.nsip.net/s\\_toc.html](http://www.nsip.net/s_toc.html) for the best and most up-to-date version.



## ■ NSIP Competition Announcement

Full details for the NSIP competition are presented in the official NSIP Competition Announcement (EP-1998-10-367-HQ). To get a copy:

- download from the NSIP web site—<http://www.nsip.net>—or
- call to request a printed copy at 1-800-848-8429, toll free.

## ■ NSIP Web Site

The NSIP web site provides additional information, learning activities, and links to sites with Mars images, data, and other resources (including all web sites listed here):

<http://www.nsip.net>

## ■ Web Sites

*Our Mission to Planet Earth: A Guide to Teaching Earth System Science* (Grades K–4) EP-1997-12-292-HQ. Available electronically from Spacelink:

<http://spacelink.nasa.gov/Instructional.Materials/NASA.Educational.Products/.index.html>  
—Then select *Educator Guides*

Numerous other NASA Educator's Guides are located at the above URL.

The GLOBE Program Global Learning and Observations to Benefit the Environment is a hands-on international environmental science and education program.

<http://www.globe.gov>

NASA Spacelink

<http://spacelink.nasa.gov>

The guidebook, *How to Access Information on NASA's Education Program, Materials and Services* (EP-1998-03-345 HQ), is available through Spacelink.

## ■ Reference Books for Teachers

*A Sand County Almanac*, Aldo Leopold, ISBN:0345345053

*Pilgrim at Tinker Creek*, Annie Dillard, ISBN:0060953020

*Earth's Dynamic Systems*, Eric H. Christiansen & W. Kenneth Hamblin, Prentice Hall 1995, ISBN:0-02-322421-5  
*The Blue Planet: An Introduction to Earth System Science*, Brian J. Skinner & Stephen C. Porter, John Wiley & Sons, Inc. 1995, ISBN:0-471-54021-8

*How Nature Works: 100 Ways Parents and Kids Can Share the Secrets of Nature*, David Burnie, ISBN:0-89577-391-0

*A Practical Guide for the Amateur Naturalist*, Gerald Durrell, ISBN:0-394-53390-9

*Discover Nature Close to Home: Things to Know and Things to Do*, Elizabeth P. Lawlor, ISBN:0-8117-3077-8

*Sharing Nature with Children*, Joseph Cornell, ISBN:0-916124-14-2

## BOOKS WITH SUGGESTED INVESTIGATIONS

*Investigating Terrestrial Ecosystems* (2nd edition), William Andrews & Donna Moore, Prentice-Hall Canada, Inc. 1986, ISBN:0-13-503186-9

*Investigating Aquatic Ecosystems* (2nd edition), William Andrews & Donna Moore, Prentice-Hall Canada, Inc. 1986, ISBN:0-13-5013129-X

## ■ Books for Children

*How the Earth Works*, John Farndon & Michael Dunning, Readers Digest 1992, ISBN:0-521-59837-0

The *Books for Young Explorers* Series, the National Geography Society

*The Young Oxford Book of Ecology*, Michael Scott, ISBN:0-19-521167-7

*Nature Cross-Sections*, Richard Orr, ISBN:0-7894-0147-9

*The Earth Atlas*, Susanna van Rose, ISBN:1-56458-626-X

*Eyewitness Living Earth*, Miranda Smith, ISBN:0-7894-0644-6

*Usborne Science and Experiments Series: Ecology*, Richard Spurgeon, ISBN:0-7460-0287-4

*Come Look With Me—Exploring Landscape Art with Children*, Gladys S. Blizzard, ISBN:0-934738-95-5

# Appendix

This is only a sample worksheet; its use is not mandatory.  
Feel free to use or modify it to suit your needs.



# MY PLANET EARTH

## Observation Log

Date \_\_\_\_\_

### Team Members' Names

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**Circle Your Element:**

AIR      LAND

WATER LIFE

Today's Question(s) \_\_\_\_\_

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**Today's Observations:** Describe what do you see, hear, feel, & smell. Include or attach pictures, measurements, maps, photos, etc. (if you need more space, use the back).

[illegible]

**Questions that you thought up:** during today's work (if you need more space, use the back).

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